

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

TITLE: DUAL USE FRONT OR REAR PROJECTION TELEVISION SET THAT  
FOLDS COMPACTLY FOR TRANSPORT AND STORAGE

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1 TITLE OF THE INVENTION:

2 DUAL USE FRONT OR REAR PROJECTION TELEVISION SET THAT FOLDS

3 COMPACTLY FOR TRANSPORT AND STORAGE

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7 CROSS REFERENCE TO RELATED APPLICATIONS:

8 NOT APPLICABLE

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11 FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT:

12 NOT APPLICABLE

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15 REFERENCE TO A MICROFICHE APPENDIX:

16 NOT APPLICABLE

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1 BACKGROUND OF THE INVENTION

2 The invention relates to television sets, particularly sets wherein the image is  
3 projected either to a separate screen located outside the set, or to a self-contained screen.  
4 In the former case known as front projection (FP), the image is formed on a display panel  
5 and light is passed through the image and onto a separate screen. In the second type of  
6 projection TV, known as rear projection (RP), the light is reflected off the image display  
7 panel and onto a screen, usually located within the set itself.

8 Projection TV has become increasingly popular as viewers demand larger and  
9 larger screens for home viewing, or for presentation to an assemblage of a number of  
10 participants in a classroom or at a conference for example. Other methods of achieving a  
11 larger picture, cathode ray tubes or plasma screens, become heavy, cumbersome and/or  
12 expensive above a screen size of about 40 inches. Thus, projection TV, offering a  
13 reasonably priced alternative, is the leading technology for large screen viewing at the  
14 present time.

15 FP display can conveniently serve the purpose of group presentation or video  
16 media in a conference room or a room at home with a large gathering by connecting the  
17 projector to a signal source. However, because of the need for an unobstructed path  
18 between projector and screen, the dangers inherent in the wiring often loosely stretched  
19 across the room, and the inconvenience of setting up the bulky screen, the FP alone is  
20 losing favor. In recent years the self-contained RP has gained an edge over the FP and is  
21 probably the most likely candidate to replace the cathode ray tube in home television.

22 The present invention is a modular system that can serve either as FP or RP. Such  
23 dual purpose capacity might be especially valuable at a meeting or conference where

1 different size groups are meeting at different times in different rooms. Furthermore, the  
2 system can be disassembled into its component parts and easily transported, since the  
3 cabinet and screen assembly fold into a compact unit, and the other components can be  
4 carried separately.

## 6 BRIEF SUMMARY OF THE INVENTION

7 This disclosure is for a projection television system comprising a frame or cabinet  
8 that can be folded into a compact unit, and other detachable components such as the  
9 projector, the optical devices, audio components and a viewing screen. The frame or  
10 cabinet when unfolded accommodates the other components in the appropriate locations  
11 for rear projection television viewing. Electrical connectivity of the assemblage is  
12 achieved by the use of slot connectors or other means that provide for quick and effective  
13 insertion of each unit into the frame or cabinet. Non electrical components, such as optical  
14 mirrors or devices, are designed so they can be removed for transport of the system,  
15 thereby reducing weight and fragility. Finally, the projector may be used as a stand alone  
16 or in conjunction with some of the other components such as speakers for front projection  
17 to a separate screen or the screen detached from the unit and set up externally.

1 BRIEF DESCRIPTION OF THE DRAWINGS

2 Figure 1 is a perspective drawing of the foldable front projection/ rear projection (FP/RP)  
3 television set.

4

5 Figure 2 is a view of the system in a FP mode using the projector, speakers, and screen  
6 removed from the set.

7

8 Figure 3 is an exploded view of one embodiment of the system.

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10 Figure 4. Is a phantom view of the system used in an RP mode.

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12 Figure 5 is a cross sectional side view of the system as used in a RP mode with one mirror.

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14 Figure 6 is a cross sectional side view of the foldable television set with a second mirror to  
15 increase optical path length.

16

17 Figure 7 is a rear view of the foldable television set showing a pleated section of the rear  
18 wall.

19

20 Figure 8 shows more detail of the folding process.

21

22 Figure 9 shows an embodiment with a rigid back, and the system partly folded.

23

1 Figure 10 is a cross sectional side view of an embodiment using a folding method wherein  
2 the back comprises rigid members which slide inside one another as the folding proceeds.

3

4 Figure 11 shows detail of rigid folding sides in another embodiment of the system. Other  
5 aspects of this embodiment are similar to the other embodiments.

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## 7 DETAILED DESCRIPTION OF THE INVENTION

8 In this invention we use various folding mechanisms to implement a number of  
9 concepts for reducing the volume of a TV during transport. Several different  
10 embodiments are described here with variations on each of the embodiments.

11 Figure 1 is a perspective view of one embodiment of the system as used in the rear  
12 projection (RP) mode. In this embodiment a main cabinet 1, supports the viewing screen 2,  
13 two speakers 3, and 4 near the lower front corners, and a door 5, in the center of the front  
14 face of the cabinet to provide access to the interior of the cabinet for removal and/or  
15 adjustment of the projector and internal optical and electronic components. All these items  
16 may be detachable for use in a front projection (FP) mode. The sides 6, and 7, of the  
17 enclosure are pleated and attached to the sloping part of the rear section 9 by means of  
18 sliding fasteners in a groove at the sides of the sloping rear section . As the sloping section  
19 folds downward the pleats compress and slide forward in the grooves until the rear sloping  
20 section reaches a limit somewhat before the vertical position. This limit is the point where  
21 the pleated sections are fully compressed and the sliding fasteners in the upper groove are  
22 touching one another.

1           Figure 2 shows an arrangement where the projector and speakers have been  
2 removed from the system and used as a conventional front projection (FP) system. The  
3 screen in this embodiment has been removed from the set and used in a standard  
4 arrangement, for example at the front of a meeting room. Using the screen from the RP set  
5 has the further advantage that it can also be illuminated from the rear as in the RP mode.  
6 When used in the FP mode, the speakers may be easily removed by simply pulling forward  
7 which disengages the electrical connectors, for example a standard type of slot connector,  
8 within the enclosure. Thus the speakers are available for use with the system in the FP  
9 mode using separate extension cables that mate with the connectors on the speakers and the  
10 projector.

11           Figure 3 is an exploded view of the above embodiment of the system showing the  
12 pleated side sections, the viewing screen, the speakers, the projector and the projector  
13 holder disengaged from the system.

14           In figure 4 the projector and screen have been replaced back into the set for RP  
15 operation. Optical paths identical to those in the FP mode may be maintained within the  
16 cabinet, resulting in the same quality picture in either mode. Figure 4 further identifies the  
17 folding floor or bottom sections of the cabinet, 22 and 23 hinged to permit folding of the  
18 set.

19           Figure 5 is a cross sectional side view of an embodiment of the system arranged for  
20 television viewing in the RP mode. Internal to the cabinet are the components that make  
21 up the optical, electronic, and possibly, other parts of the system. The main projector 11, is  
22 removable from the front of the cabinet. It mounts on a fixed carrier 15, that locks into  
23 position and holds the projector rigidly in place In the configuration shown in figure 5.

1           The television beam is reflected by a single mirror 13, to the rear side of the  
2   viewing screen 2. In another arrangement, a second mirror may be added and the projector  
3   operated facing downward to increase the optical path length and further reduce the  
4   system bulk. Such an arrangement is shown in figure 6.

5           In the embodiment shown in figure 6, the cabinet or frame comprises seven  
6   sections, a main cabinet 1, two flexible side sections 6, and 7 (not visible in the cross  
7   section), a vertical rear section 8, a sloping rear section 9, and two bottom or floor sections,  
8   22 and 23. The rigid main cabinet 1, makes up the front face and serves as the carrier, a  
9   sort of box for the rest of the system as the system is folded into a compact unit within  
10   and/or against the main cabinet 1. The two sides, 6 and 7, are bellows-like structures in  
11   this embodiment that compress with the folding down of sloping rear section 9, to which  
12   they are slideably connected at the top. The rear vertical section 8, is made up of a lower  
13   rigid part and an upper bellows part as shown in the rear view, figure 7. The rear sloping  
14   section 9, supports mirror 13, on its inside and is itself a rigid structure. This rear sloping  
15   section is attached to a set of telescoping tubes 24, one on the inside of each rear corner of  
16   the section to maintain the alignment and rigidity of the system during the folding  
17   operation. The bottom section or floor is made up of two pieces 22, and 23 that are hinged  
18   to each other and to the front and rear sections of the system as was shown in figure 4.

19           The system is folded by first releasing all the latching fasteners 21 of figure 7,  
20   (after removing the projector and any other detachable items) then lifting upward at the  
21   hinged joint joining rigid bottom sections 22 and 23 while pressing downward on the rear  
22   sloping section 9. As the folding proceeds, the telescoping tubes 23 guide the rear sloping



1 section 9 until it reaches the rigid lower part of rear section 8. At this point the folding  
2 process is complete and the cabinet is in the fully compacted position. shown in figure 9.

3 Figure 10 shows another embodiment of the system as used in RP mode. This  
4 embodiment comprises a multi-piece cabinet made up of seven sections to house the  
5 components. Section 1 is the base cabinet to which the other components attach directly  
6 or indirectly. Sections 6 and 7 make up the sides of the system cabinet pleated as in the  
7 previous embodiment. The vertical rear section 8, instead of the being partly pleated, it is  
8 one rigid section, Folding proceeds in a way similar to the previous embodiment but  
9 sloping rear section 9, slides downward inside and contacting the rigid rear section 8 on  
10 either side by means of slideable attachments in a groove in rear section 8. Rigid vertical  
11 rear section 8 is attached hingeably to bottom sections 22 and 23. Sloping rear section 9  
12 completes the closure of the structure, being hingably attached to the base cabinet 1 at the  
13 top of the system, and slideably attached to the vertical rear section 8. Bottom sections 22  
14 and 23, are hingeably attached to each other and to the base cabinet 1, at the front of the  
15 set, as well as to the rear vertical section 8

16 In this embodiment, folding proceeds as follows: After opening its removal  
17 doorway 5, projector 11, is electrically disconnected, disengaged from its support and  
18 removed from the system by pulling forward. After removal of the projector, any  
19 additional removable components may be removed through the opening where the  
20 projector previously resided. At this point, a slight lifting on the bottom sections 22 and 23  
21 at the point where they are hingeably connected will start the folding operation.  
22 Simultaneously, a downward pressure on rear sloping section 9 allows it to slide  
23 downward while remaining connected to rear section 8 by means of sliding members in a

1 groove. This process is shown in figure 8 where the system is partly folded. As the  
2 folding process proceeds, an optical component, said mirror 13, swings forward while  
3 remaining attached to rear sloping section 9.

4 After being fully folded, the system appears as shown in figure 10. A latching  
5 mechanism is provided to lock the system together in the fully folded position where it  
6 may be handled easily and carried in any position.

7 Details of the folding sides in a third embodiment is shown in figure 11 as a  
8 variation of the first embodiment. In this version, the sides of the cabinet 6 and 7 are rigid  
9 and hingeably attached to the main cabinet section 1 at a point far enough rearward that  
10 these sides fold inward into the base cabinet 1. A latching mechanism then binds the entire  
11 system together in a compact bundle. This same hinged rigid side arrangement may also  
12 be applied to either of the embodiments previously discussed.

13 The screen itself, although appearing herein to be a rigid structure, may actually be  
14 made of a flexible material and designed to fold or roll up for storage or transport, or used  
15 separately for another purpose.

16 After removing the projector from the cabinet, the projector becomes a free-  
17 standing unit and may be used as a front projection assembly with a separate screen or the  
18 screen removed from the foldable TV set. Thus, the use of a standard projector in this  
19 system adds a great deal to its versatility.

20 Although three embodiments of the system with variations have been shown in  
21 some detail here, other modifications based on these principles will undoubtedly occur to  
22 one skilled in the art. The particular details presented here are not intended to limit the  
23 invention to these embodiments, but to show some applications of the principle of folding

1 to achieve a compact transportable unit. The invention is intended to encompass all  
2 embodiments that employ the same basic principles.

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